

University of Toronto at Scarborough
Department of Physical and Environmental Sciences

EES A06: Introduction to Planet Earth

Winter 2018

10 online lectures

Professor Nick Eyles

Note: Professor Eyles is on sabbatical in early 2018 and the course will consist of 10 pre-recorded online lectures. The course will be managed by **Dr. Kirsten Kennedy**.

Structure of the course

This course consists of 10 lectures, a mid-term and final exam (each worth 30%) which are 'open book', and **either** a research poster (40%) which can be completed either individually or in groups of up to 4 or completion of four online modules question sets

through solid rock? Today, it is realized that continents are simply part of larger lithospheric plates which move in their entirety over hot plastic rocks below; this process is called *plate tectonics* and it has been in operation for at least 3.5 Ga. It may not be the only way in which planet Earth functions however and there is increasing recognition of so-called *vertical tectonics* involving giant mantle plumes of hot rock, and the outpouring of enormous volumes of magma (flood basalts, supervolcanoes etc.,) when these plumes reach the Earth's surface. These are called Large Igneous Provinces (LIPs for short).

Lithospheric plates are formed at so-called 'mid-ocean ridges' (also called 'spreading centers') where new volcanic magma rises to the surface from the underlying mantle and cools to add to the edge of the plate. Continuous addition of new magma and its cooling, results in continuous growth of the plate away and its movement away from the spreading centre (hence its name). This is clearly seen in Iceland today where the mid-Atlantic Ridge is exposed on land and separates the North American plate from the European plate which move in opposite directions away from the spreading centre. The North American landmass is part of the plate and it is moving westward; here in Toronto we are moving at 3.7 cm every year. In the 50 years that UTSC has been in existing it has moved almost 2 m westward from its original position.

The movement of plates leads to collisions between adjoining plates (called *orogeny*) and destruction of some plates by a process called *subduction* where one plate (usually the oldest) is driven down below the other. This is happening

Ancient environments are preserved in the form of rocks and by study of the rock record we can reconstruct ancient paleoenvironments. The concept that the present is the key to the past is called *uniformitarianism*. Apart from catastrophic events like large meteorite impacts that result in widespread extinctions, the concept has served geologists well. We shall examine the history of life on planet Earth and how it reflects broader tectonic and climatic events.

The course concludes by looking at the 4 billion years long geological history of Canada and Ontario including reference to modern environmental problems facing Canadians. We will look at the causes and impacts of climate change, mineral exploration and mining, the impact of urban development, disposal of a wide variety of wastes, the clean-up of contaminated sites and waters, and the key role that environmental geoscience plays in our society.

At the conclusion of this course you will know how planet Earth 'works' regardless of your course of study. This knowledge is key to protecting our complex human world which is subject to natural disasters, the need to protect the environment and to find ever scarcer resources and extract them in an environmentally-sustainable fashion.

Course textbooks and other resources

The course is organized around the 5-part Geologic Journey- World series which aired on Canadian Broadcasting Corporation's 'The Nature of Things' in late 2010 with David Suzuki and myself and *which is available on Blackboard*. It is based on the geology of various parts of the world and you will need to watch these to supplement lectures.

The course textbook is ***Ontario Rocks - Three Billion Years of Environmental Change*** which frames the geological history of Ontario against what is known of

Also take a look at the real time map of *global earthquakes* on the video display in the Atrium of our new Environmental Sciences and Chemistry building. That's our Earth at work right in front of your eyes.

Evaluation and marks

The course will be evaluated by:

- a) Multiple-choice mid-term exam of 100 true/false questions based on lectures 1-7 and Chapters 1-6 in *Ontario Rocks* 30 marks.

- b) *Either*. A poster assignment on a topic illustrating aspects of the geology of Canada or Ontario. This can be done either individually or in student groups of up to 4, and will be presented at a '*Planet Earth Conference*'

Things to remember

1. Please check the Blackboard course site regularly for updates and commonly asked Questions and Answers. Dr. Kennedy will be available during regularly scheduled office hours which will be announced on Blackboard.

2. **Plagiarism** (such as the use of posters from previous years) will not be tolerated; it is an academic offence and will be immediately reported to the Dean who will issue appropriate penalties.

4. **AccessAbility Services:** Students with diverse learning styles and needs are